



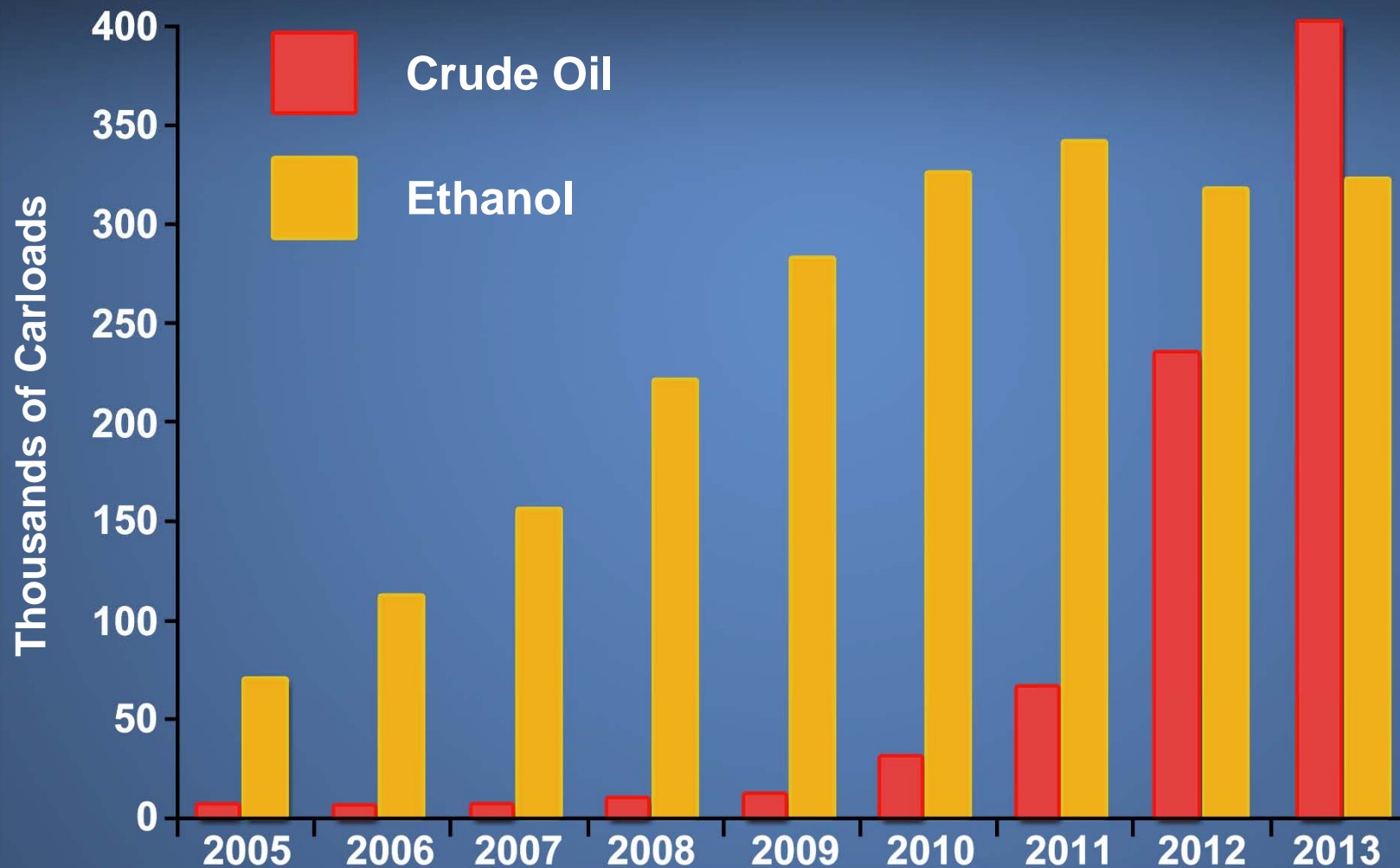
**National
Transportation
Safety Board**

Rail Accidents Involving Crude Oil and Ethanol Releases

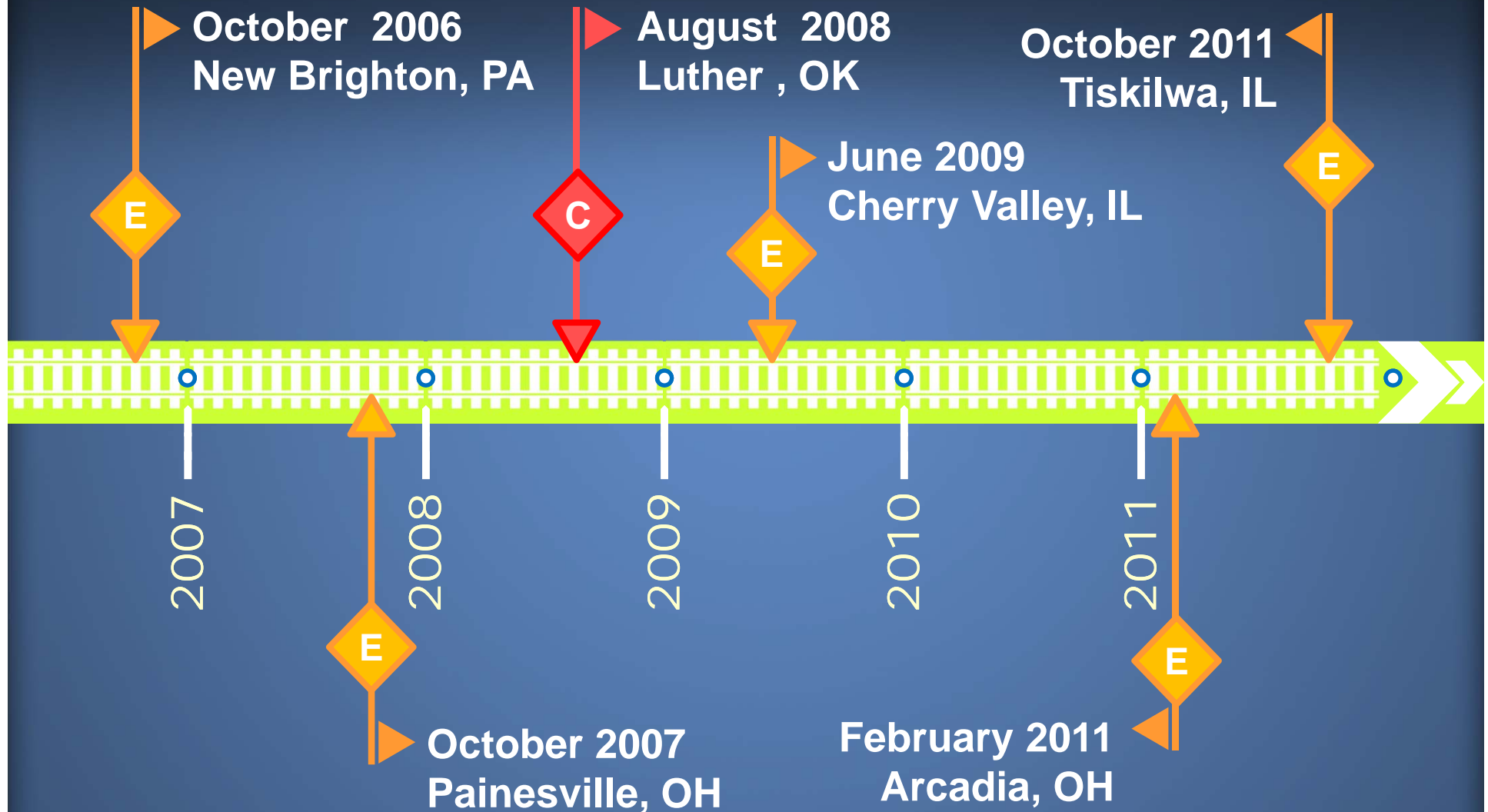
Paul L. Stancil

Sr. Hazardous Materials Accident Investigator

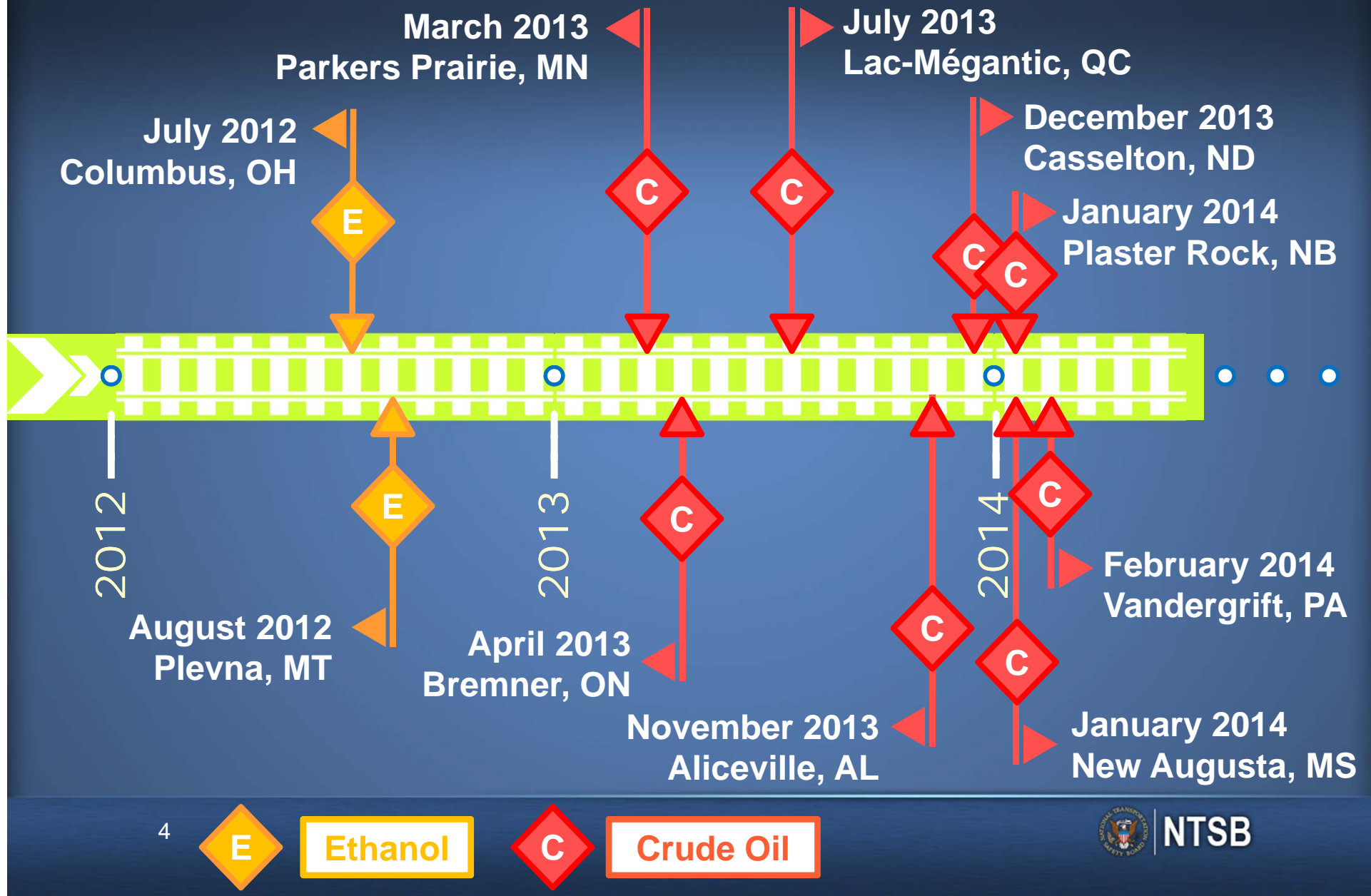
Crude Oil and Ethanol Rail Carloads



Significant Crude Oil and Ethanol Accidents



Significant Crude Oil and Ethanol Accidents



Crude Oil and Ethanol Accidents

- 16 significant accidents since 2006
 - 9 crude oil
 - 7 ethanol
- 48 fatalities
- 281 DOT-111 tank cars derailed
- 2.8 million gallons crude oil released
- 2.0 million gallons ethanol released
- Fires and environmental damage

Safety Issues

- DOT-111 tank car crashworthiness
 - Puncture resistance
 - Thermal resistance
 - Fittings protection
- Railroad operations
 - Route planning and route selection
 - Hazardous materials classification
- Emergency response
 - Planning
 - Response capability
 - Awareness and training

Rail Safety Forum

- Tank Car Design, Construction and Crashworthiness
- Railroad Operations and Approaches to Risk Management
- Emergency Response to Tank Car Releases of Crude Oil and Ethanol
- Federal Oversight and Industry Initiatives

Head Protection

Federal regulations do not require head shields

Bare Head

Full Head Shield

DOT-111 TANK CAR

Head Puncture

Lac-Mégantic, QC, 2013



Casselton, ND, 2013



Puncture Resistance

Pressure tank cars are between 9/16 inch and 11/16 inch thick

Tank Material 7/16 inch



Shell Cracking and Tearing



Cherry Valley, IL, 2009



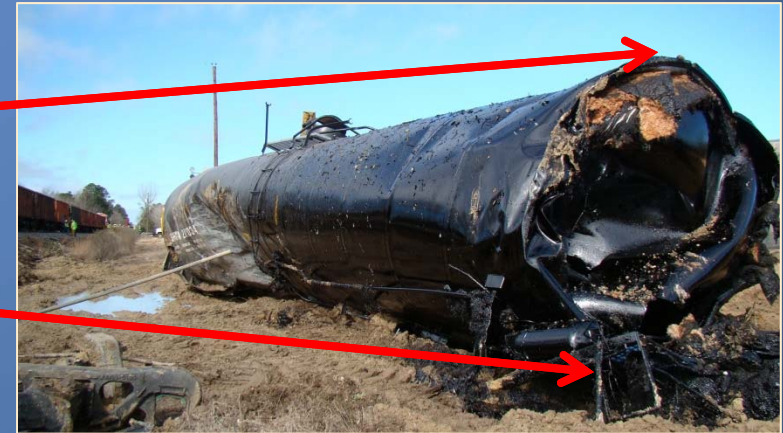
Lac-Mégantic, QC, 2013

Loss of Containment Volume

Lac-Mégantic, QC, 2013



New Augusta, MS, 2014



Thermal Resistance

- No requirement for tank jacket
- No requirement thermal protection



Thermal Failure and Fireball Release



- No tank jacket
- No thermal protection
- Insufficient pressure relief capacity

Columbus, OH, 2012



Energetic Ruptures



Arcadia, OH, 2011

Top and Bottom Fittings Protection

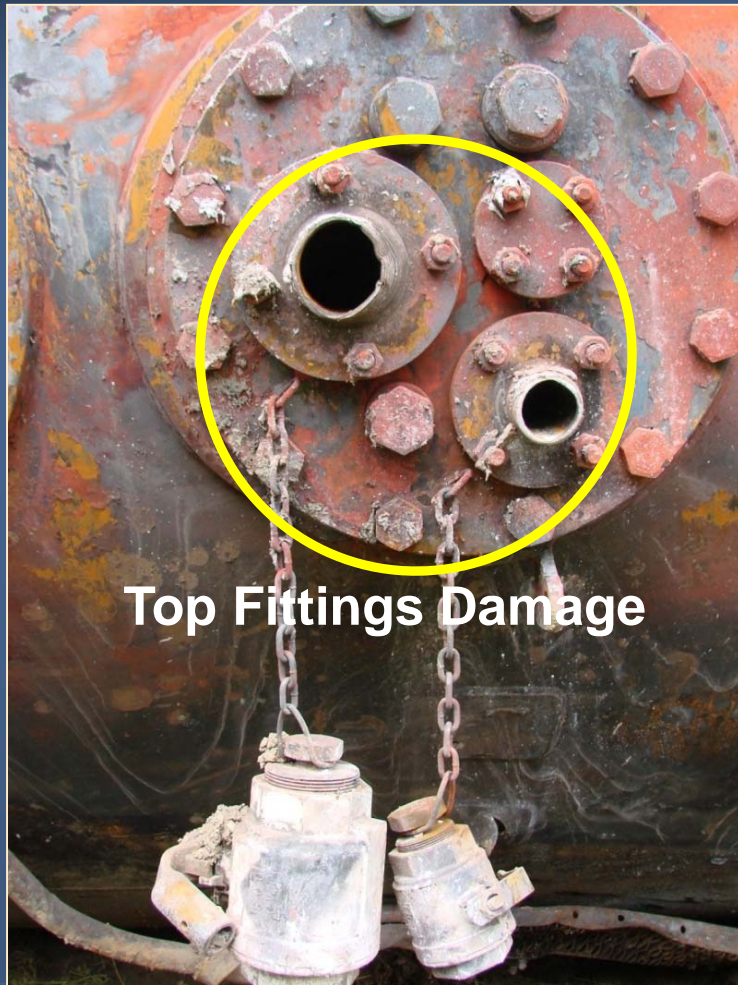
Top Fittings

DOT-111 TANK CAR

Bottom Fittings

Top and Bottom Fittings Vulnerability

Cherry Valley, IL, 2009

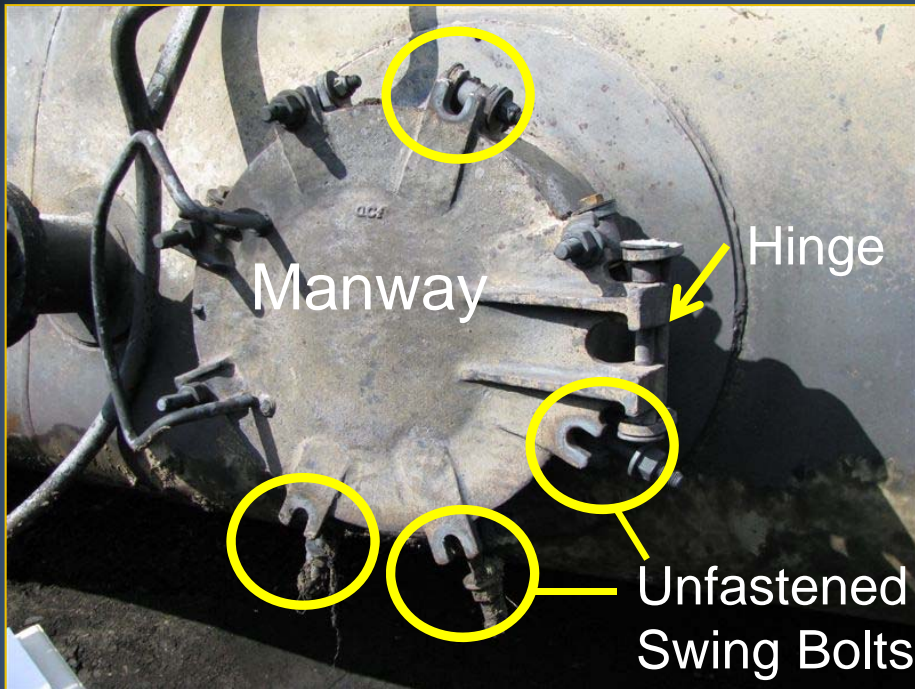


- Fittings not adequately protected

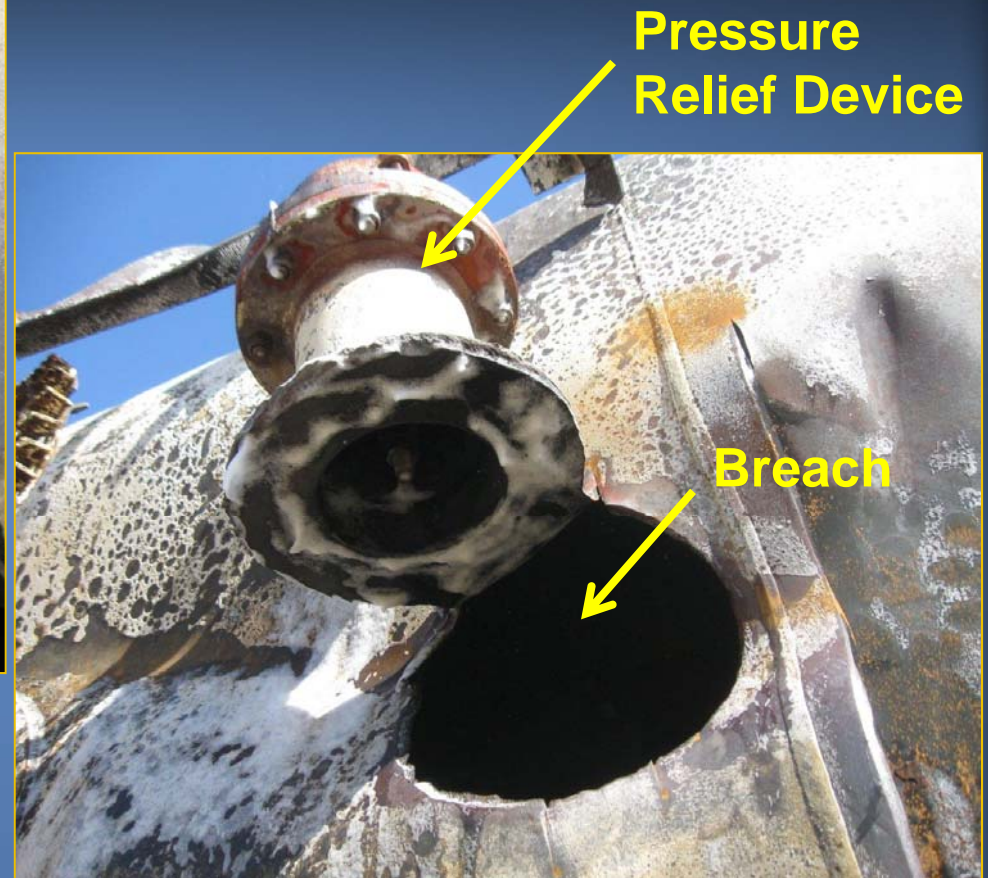
Casselton, ND, 2013



Top Fittings Failures



Lac-Mégantic, QC, 2013



Tiskilwa, IL, 2011

NTSB and TSB Canada Investigations

- NTSB – 6 investigations
 - New Brighton, PA October 20, 2006
 - Painesville, OH October 10, 2007
 - Cherry Valley, IL June 19, 2009
 - Tiskilwa, IL October 7, 2011
 - Columbus, OH July 11, 2012
 - Casselton, ND December 30, 2013
- TSB Canada – 3 investigations
 - Bremner, ON April 3, 2013
 - Lac-Mégantic, QC July 6, 2013
 - Plaster Rock, NB January 7, 2014

Open NTSB Safety Recommendations

- R-08-12 and -13: Separation of hazardous materials for train crew protection
- R-12-5: Tank head and shell puncture-resistance systems and top fittings protection
- R-12-6: Bottom outlet valve closure
- R-12-7 and -9: Draft sill attachments with appropriate weld separation
- R-07-2 and -4: (reiterated) Hazard communications for emergency responders

Open NTSB Safety Recommendations

- R-14-1 and -4: Expand route planning and selection to key trains transporting flammable liquids
- R-14-2 and -5: Comprehensive oil spill response plans for worst case discharges
- R-14-3: Audit safety and security plans
- R-14-6: Sufficient hazardous materials testing and classification

Active TSB Canada Safety Recommendations and Advisories

Safety Recommendations

- R07-04: Standards for Class 111 tank cars in dangerous goods service
- R14-01: Crashworthiness of Class 111 tank cars
- R14-02: Route planning and analysis for trains carrying dangerous goods
- R14-03: Emergency response assistance plan requirements

Safety Advisories

- RSA 12/13 and 13/13: Determination of crude oil properties for safe transportation
- RSA 15/13: Operating lever design for bottom outlet valve



National Transportation Safety Board